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Notes on the zygospores of certain New England desmids with descriptions of a few new forms

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(WITH PLATES 7 AND 8)

While desmids in their ordinary vegetative condition are very common, they are much less frequently found in conjugation. When found in this condition their characters are always worthy of notice. The zygospores of a considerable number of American species have been figured by Wolle and a few by later writers on American desmids, but there are many species of which the zygospores are as yet unknown. In many cases the figures given by Wolle have been found inaccurate by later writers. The formation of zygospores, aside from its comparative rarity, is always an interesting process. There appear to be various stages in the formation of the spines, as well as other characters, which need more attention to be fully understood.

A close study of the zygospores of various desmid groups should reveal something concerning relationships and should determine somewhat the validity of one or the other of the two classiclassifications, one based on form alone, the other on arrangement of cell-contents. This should be especially true in the relationships of various groups within the genus. On the other hand, certain species which are almost exactly alike both in external form and structure of contents have zygospores which are widely different in character. Whether such forms should be separated on the basis of differences in the character of their zygospores, representing fruiting conditions, or should be kept close together on the basis of similar form and structure in their vegetative state, is a question to be settled by extended work upon the zygospores of a considerable number of species.

Whether the zygospores of a single species are always constant in their characters is also somewhat of a question. If they are not constant, their use as a basis for any sort of division is at once seen to be valueless.

The following forms were found in collections made at Pondville, in May, 1903; South Framingham and Reading, Mass., May, 1904. The first two collections were made by the writer, and the last by Mr. G. A. Fisher.

CLOSTERIUM DIANAE Ehrenb. PLATE 7, FIGURES 1–3.

In the series shown, certain definite steps are represented. In *fig. 1* the two cells have each broken apart and their contents extruded and united. At this stage it consists of two portions: an outer clear, hyaline mass and an inner more dense portion with many chlorophyl-granules and oil-globules. The outer margin of the clear mass forms a perfect sphere. In the breaking of the cells in the beginning there may be three conditions. They may open as in *fig. 1*, but leaving no definite line of breakage across the cell, looking at first glance as if it were more of a stretching than an actual break. This condition was frequently noted.

In the second condition, as in *figs. 2* and *3* (the lower cells), there may be a definite break in the middle, but the two parts remain attached to one another. In the third case, as in the upper cell of *fig. 3*, the two portions become entirely separated. This last stage is interesting when compared with the following species.

In the next stage in the formation of the zygospore (*fig. 2*), the mass containing the chlorophyl is gathered together at the center, forming a spherical mass about which the hyaline portion forms an outer covering. At this stage it is considerably smaller than at first (*fig. 1*). In the final stage the chlorophyl mass remains about the same size as in *fig. 2* and the outer portion forms a thickened wall.

Specimens in all these three stages were very common in the material collected by Mr. Fisher at Reading.

Diameter of the completed zygospore, 36–40 μ.

CLOSTERIUM LINEATUM Ehrenb. PLATE 7, FIGURES 4–6.

In this species there are two things of especial interest when compared with the foregoing. The cells are completely separated and the semicells resulting adhere in a peculiar manner to the outside of the hyaline mass, extending directly outward from the surface. This condition is more like the third case mentioned under *Closterium Dianae*, but there the semicells do not adhere in the peculiar manner of this species. Wolle does not show this character in either of his figures of fruiting specimens of this species. All the specimens seen had this character.

The second character is the variation in the production of either single or twin zygospores, the latter condition being much the more frequent. With the exception of the above characters the stages are comparable to those seen in the preceding species. Fruiting specimens of this species were also abundant in the collection from Reading.

Diameter of completed zygospore, 78 μ.

MICRASTERIAS PAPILLIFERA Bréb. PLATE 7, FIGURES 7, 7a.

The zygospore of this species was figured in Ralf's British Desmids, and that I believe is the only original figure of the species in its fruiting condition. The zygospore is large with fairly large and stout spines, many of them bifurcate at the tip. Just before the spore is fully formed there is a gelatinous covering which extends partway out upon the spines. This disappears as the zygospore reaches completion, entering probably into the formation of the covering. The form of the zygospore is not exactly spherical, but slightly elongated.

Lat. zyg. s. sp. 75 μ; c. sp. 95 μ; long. zyg. s. sp. 75 μ; c. sp. 103–105 μ.

Common in the material from Reading.

PENIUM CLEVEI CRASSUM W. & G. S. West. PLATE 7, FIGURE 8.

This variety was found to be common in the material from Pondville, making the first record for it in America. The zygospore both of the typical form and of the variety has hitherto been unknown. It is spherical with numerous, broad, squarely truncated spines as in the figure. The cells in the figure have not the roughened apices which, however, they do possess in the specimens.

Long. cell. 80–84 μ, lat. 40–44 μ: diam. zyg. c. proc. 68–78 μ, s. proc. 54–57 μ.

Cosmarium pseudoorbiculatum sp. nov. PLATE 7, FIGURE 9.

This species has been confused with *C. orbiculatum* Ralfs. It is evidently the same as that figured and described by Delponte as *C. orbiculatum* (Memor. R. Accad. Sci. Torino II. **28**: 11 (107). *pl.* 7, *f.* 46–48. 1877), agreeing exactly in form and size. The form of the semicells is more oval in front and end view than in Ralfs' species and may in this way be best distinguished. But the zygospore is very different, holding a place distinctly apart from the usual type of *Cosmarium* zygospore. That of *C. orbiculatum* is spherical with the usual type of short conical spines. In the present species it is a decided oblate spheroid, on one end evenly convex, on the other concave in the middle forming a distinct pit of considerable size. The zygospore has from sixteen to twenty lamellar plates extending from pole to pole, evenly scalloped, each plate with about ten spines broadly elliptical at the base, becoming circular at the broadly truncated apex. The portions between the lamellae are indistinctly striate. Altogether this forms a very curious type of zygospore for this group.

Long. 40 μ, lat. 28 μ, lat. isthm. 6.5 μ, crass. 21.5 μ.

Long. zyg. c. sp. 34 μ, lat. zyg. c. sp. 50 μ.

Common in fruiting condition at Pondville, Mass.

Sphaerozosma readingensis sp. nov. PLATE 7, FIGURES 10, 10*a*.

Sphaerozosma, smooth, without exterior ornamentation, sinus deep, somewhat gaping, end view broadly elliptical, semicells in side view nearly circular, in front view nearly three times as wide as long; cells connected by two glandular processes with a third projection between them in the middle of the end of the semicell (*fig. 10a*).

Zygospore much like that of *S. Aubertianum* figured by W. and G. S. West, with fairly long acicular spines.

Lat. cell. 28 μ, long. 22 μ, lat. isthm. 6.5 μ.

Lat. zyg. s. sp. 25 μ, lat. zyg. c. sp. 52 μ.

Common in the collection from Reading, Mass.

STAURASTRUM BREVISPINUM Bréb. PLATE 8, FIGURES 12, 13.

In *figure 12* is shown an early stage in the formation of the zygospore. There is a central mass, green in color, surrounded by an outer hyaline covering. At the stage figured this consists of two distinct portions, the inner one of which evidently becomes the main wall of the zygospore, while the outer one is used up in the development of spines.

Figure 13 shows the completed zygospore of the same species.

Lat. cell. c. sp. 38 μ, s. sp. 32 μ, lat. zyg. s. acul. 32 μ, lat. zyg. c. acul. 72 μ.

This species was very common in a fruiting condition at South Framingham, Mass.

Staurastrum brevispinum basidentatum var. nov. PLATE 8, FIGURE 11.

Differs from the typical form in having three teeth at the base of each semicell. The zygospore is much like that of the usual form (*fig. 13*), but is somewhat smaller and has fewer spines.

Frequent at Pondville, Mass.

STAURASTRUM DILATATUM Ehrenb. PLATE 8, FIGURE 14.

The small specimen here figured seems best referred to this species. The zygospore is elliptical, covered with rounded protuberances. Whether this was the completed form of the zygospore or not was not fully determined.

Lat. cell. 22 μ, long. zyg. 28 μ, lat. zyg. 22 μ.

This small species was found in a fruiting condition at Reading, Mass.

STAURASTRUM GRANDE Bulnh. PLATE 8, FIGURE 17.

Figure 17 represents the typically punctate form of this species. The zygospore is large, angular, with broad, often somewhat curved spines, scattered sparsely over the surface. As far as I am aware the zygospore of this species has not been figured.

Lat. cell. 65–85 μ, lat. isthm. 12–14 μ: lat. zyg. s. sp. 60 μ, lat. zyg. c. sp. 100 μ.

Found occasionally in the collection from Reading, Mass.

Staurastrum grande glabrum var. nov. PLATE 8, FIGURES 15, 16.

This variety is much like the typical form, except that it is entirely smooth, lacking the punctate character of the former. It is slightly smaller than the typical form and is at once distinguished from var. *rotundatum* W. & G. S. West which differs from it in shape.

The zygospore of our variety is considerably different from that of the typical form. It is of about the same size, but much less angular and more densely set with shorter and more slender spines.

Figure 15 shows an early stage in the formation and *figure 16* the completed zygospore.

Lat. cell. 55–62 μ, lat. zyg. s. sp. 59 μ, c. sp. 84 μ.

This variety was much more frequently found than the typical species in the material collected by Mr. Fisher at Reading, Mass.

Staurastrum polytrichum readingense var. nov. PLATE 8, FIGURES 18, 18*a*.

This variety differs from the typical form in being more densely set with smaller and shorter spines. In other characters it is much the same.

The fruiting condition of this species has, I believe, not been figured. The zygospore of this variety is a peculiar one. It is in the main spherical and is thickly set with spines having a broad base and a trifid apex each portion of which is bifurcated. The whole zygospore including the spines is thickly set with large elongated granules giving a peculiar appearance, especially to the spines. The detail of a single spine showing this condition is given in *figure 18a*.

Lat. cell. 52 μ, lat. isthm. 16 μ: lat. zyg. s. sp. 53 μ, lat. zyg. c. sp. 78 μ.

Found at Reading, Mass.

STAURASTRUM EUSTEPHANUM (Ehrenb.) Ralfs. PLATE 8, FIGURES 19, 19*a*.

The zygospore of this species has, I think, never been figured. It is spherical in form with many processes, fairly wide at base, but on the whole slender. Near the top it divides into three branches, each one of which is again divided and the tips of the divisions bifurcate.

Lat. zyg. s. proc. 45 μ, c. proc. 84 μ.

Found both at Pondville and at Reading, Mass.

Wolle figures three distinct forms of this species. One of these (*pl. 59, figs. 4–6*) is smaller than the typical form with "spreading swallowtail-like ends of processes." This may be called var. **minnesotense** *nobis*. He also figures another variety (*pl. 59, fig. 11*), with elongated processes. This variety may be called var. **Wolleanum** *nobis*.

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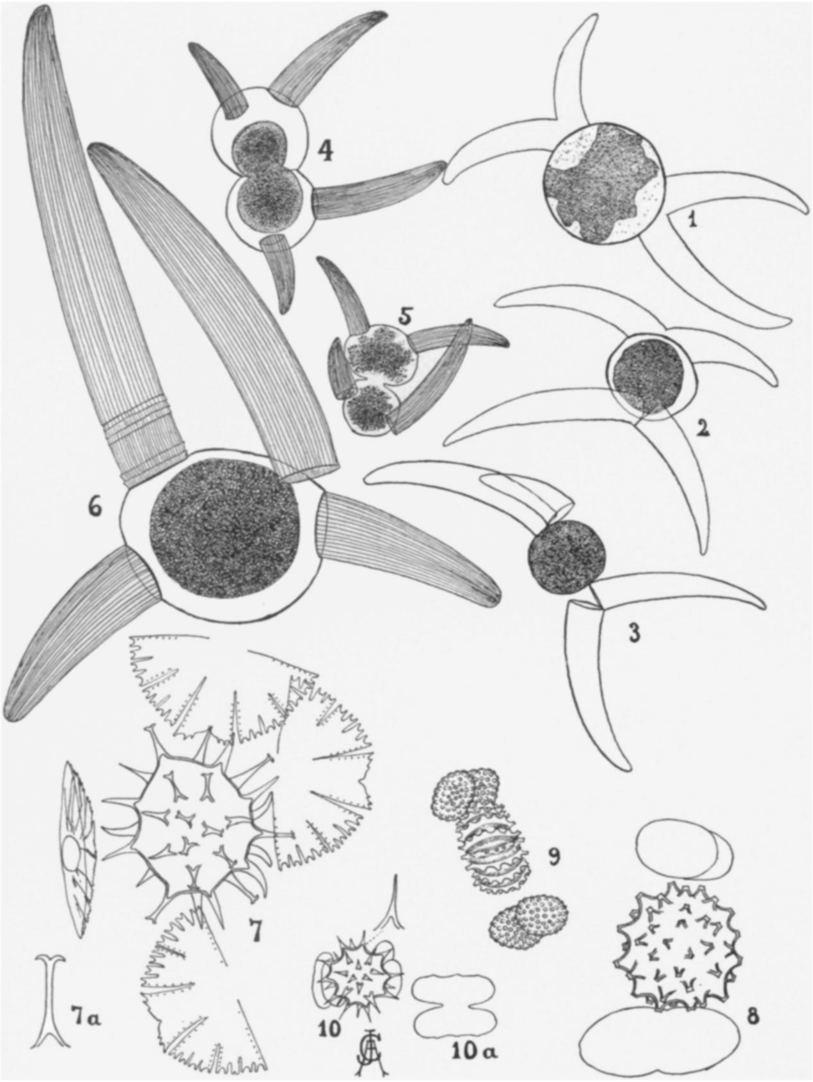
Explanation of plates 7 and 8

PLATE 7. × 220

FIGURES 1–3. *Closterium Dianae* Ehrenb.
FIGURES 4–6. *Closterium lineatum* Ehrenb.
FIGURES 7, 7*a*. *Micrasterias papillifera* Bréb.
FIGURE 8. *Penium Clevei crassum* W. & G. S. West.
FIGURE 9. *Cosmarium pseudoorbiculatum* sp. nov.
FIGURES 10, 10*a*. *Sphaerozosma readingensis* sp. nov.

PLATE 8. × 450

FIGURE 11. *Staurastrum brevispinum basidentatum* var. nov.
FIGURES 12, 13. *Staurastrum brevispinum* Bréb.
FIGURE 14. *Staurastrum dilatatum* Ehrenb.
FIGURES 15, 16. *Staurastrum grande glabrum* var. nov.
FIGURE 17. *Staurastrum grande* Bulnh.
FIGURES 18, 18*a*. *Staurastrum polytrichum readingense* var. nov.
FIGURES 19, 19*a*. *Staurastrum eustephanum* (Ehrenb.) Ralfs.



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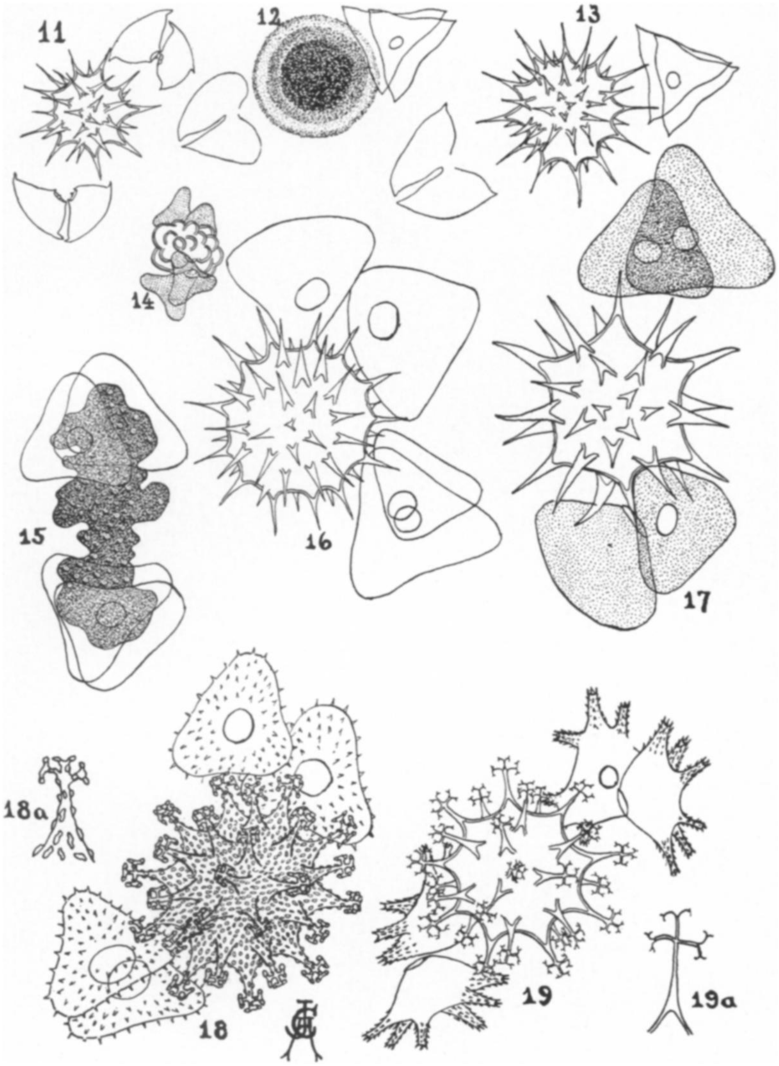

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